

Pinus nigra

Description of model and ensemble projections

The current distribution of *Pinus nigra* is not projected to really occur in Switzerland based on the pan-Alpine data basis used in the MANFRED project. The model predicts a total of 4 km² of suitable habitat, which can be neglected. The species occurs in more Eastern and Southern mountains at low to mid altitude, under more Mediterranean and continental climates. Within the Alps, it can be found at the South-Eastern edge of the Alps in NE-Italy, Northern Slovenia and SE Austria.

Under projected climate change using the A1B scenario, most combinations of statistical and regional climate models predict a spread of *P. nigra* into the Valais, and finally even onto the Plateau, meaning that these regions will soon have climate conditions, under which *P. nigra* will find comparable habitats to its current range.

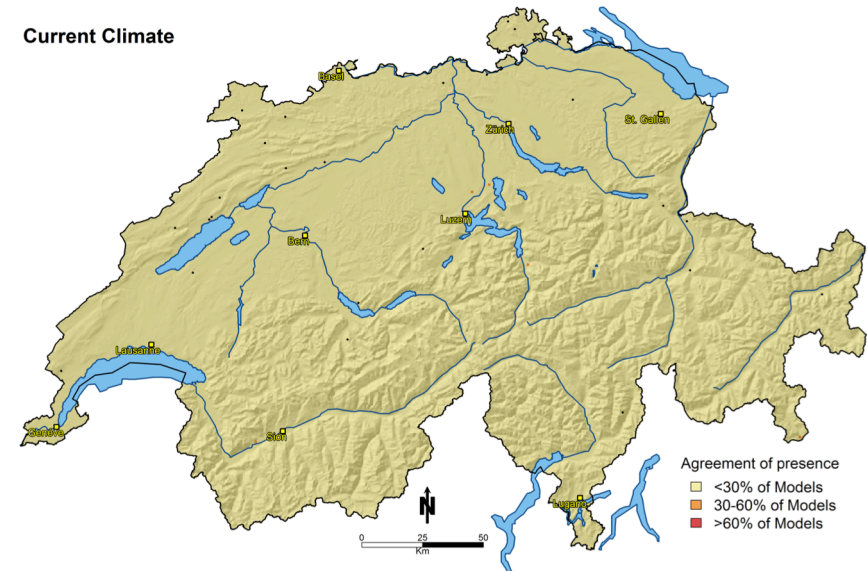


Figure 1. Current distribution (black dots) from the Swiss National Forest inventory (LFI 1) and simulated habitat suitability under current climate as calibrated from forest inventory data across the Alps (MANFRED project).

Synthesis and Conclusions

The Alps-wide model (not shown here) fits the distribution of *P. nigra* quite well, and can therefore be considered a credible model to project the future habitat suitability of the species. The ensemble model projects a 33% overlap between the current and the future range in Switzerland (from insufficient numbers of pixels). Yet, it also finds a comparable overlap (22%) in Europe. This may be considered a sufficient overlap to conserve the species without extreme efforts.

However, the species will lose ca. 75% of its European range, despite enlarging its range into Switzerland massively. Compared to *P. sylvestris*, *P. nigra* is a bit more drought and heat tolerant, and might be a viable management alternative from this perspective.

Yet, the species likely will not migrate to Switzerland without assistance. It cannot cross the Alps and the distance around the Alps is way to far to be colonized by natural migration. It also is currently unclear, if it can thrive well on deeper soils on the Swiss Plateau under increased bark beetle risks. On the other hand, *P. nigra* has become naturalized in many regions of the US, and in New Zealand it is considered an invasive species and noxious weed. It therefore could well establish in a warmer and drier climate, once introduced.

Range change statistics		
	CH	Europe
Current range size [km ²]	6	90'267
Future (2080) range size	7'568	24'877
Range Change 2080/2000 [%]	>999%	27.5%
Overlap 2000/2080 [km ²]	2	19'641
Overlap/current range [%]	33.3%	21.7%

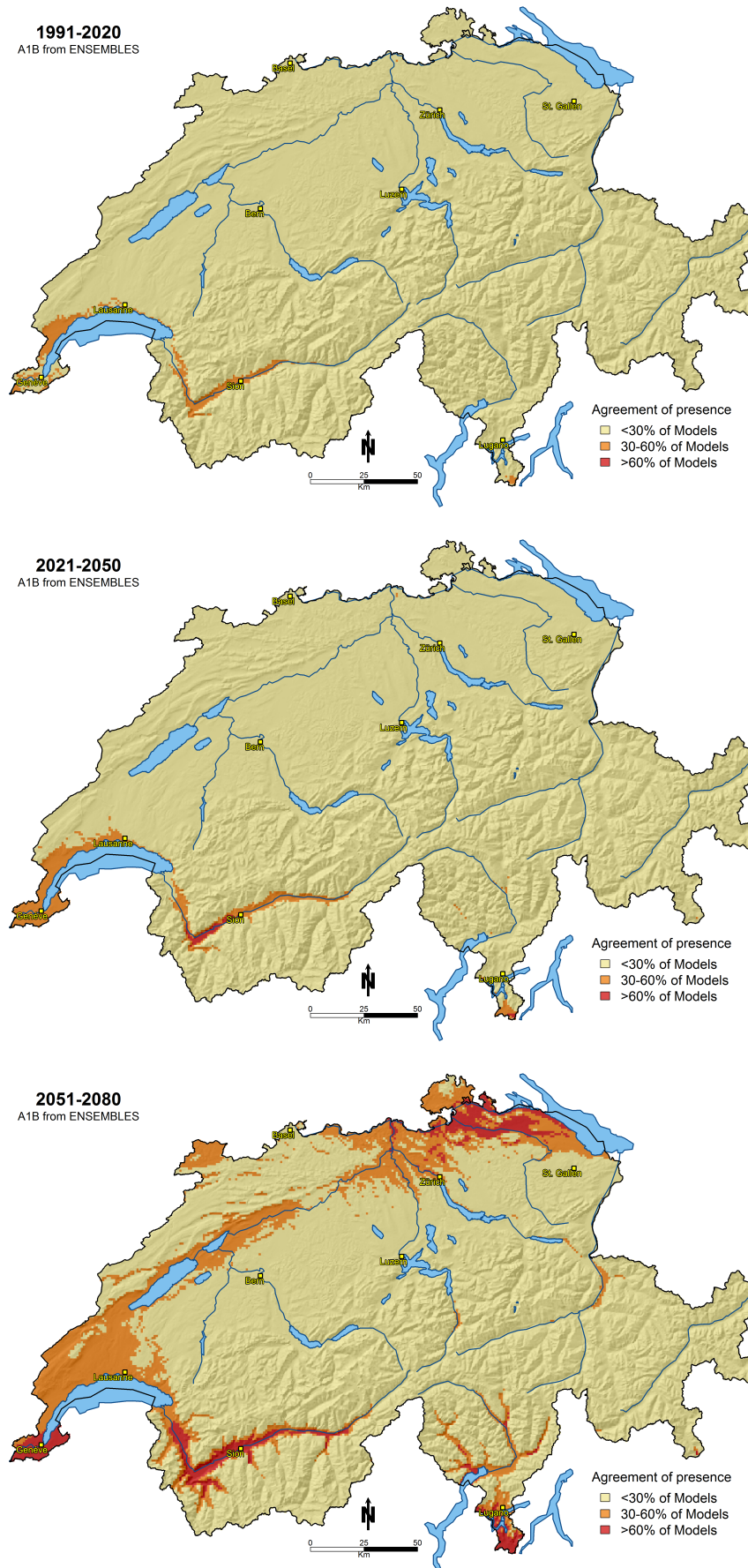


Figure 2: Ensemble of projected future ranges of suitable habitat as modeled from six RCMs and six statistical models. Light yellow colors indicate that all climate & statistical model combinations project absence of the species, while dark red colors indicate presence. Orange colors indicate uncertainty regarding habitat suitability.